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Liao

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(54) **LIGHT EMITTING DEVICE**

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H05B 33/08 (2006.01)

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CPC ***H05B 33/0851*** (2013.01); ***H05B 33/089*** (2013.01); ***H05B 33/0809*** (2013.01)

(58) **Field of Classification Search**
CPC H05B 33/0815; H05B 33/0845; H05B 33/0854; H05B 37/02; H05B 33/0851; H05B 33/089
See application file for complete search history.

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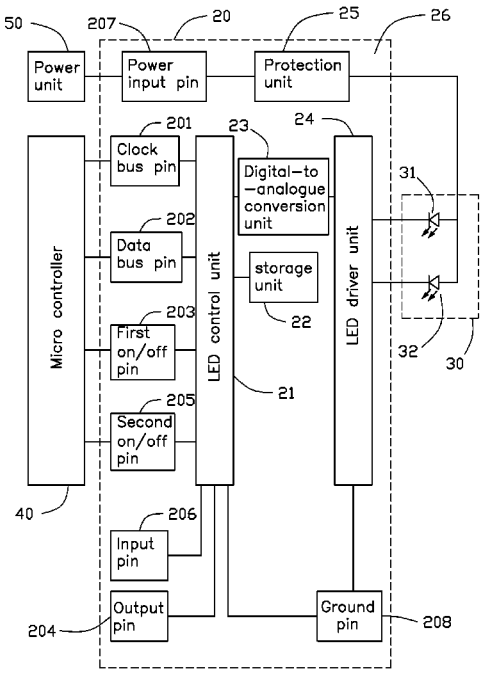
(57) **ABSTRACT**

A light emitting device includes at least one light emitting unit, a micro controller and a control module. The control module includes a storage unit configured to store a reference sheet between an intensity of the light emitting unit and a current value of the light emitting unit. A light emitting diode (LED) control unit is configured to receive a control signal from the micro controller. A digital-to-analogue conversion unit is configured to transform the current value and the on/off status to a simulation signal. A LED driver unit is configured to control the on/off status and the intensity of the light emitting unit based on the simulation signal. The control module further includes an input pin and an output pin, and the input pin is electrically connected with output pin in series when the multiple light emitting devices are provided.

13 Claims, 3 Drawing Sheets



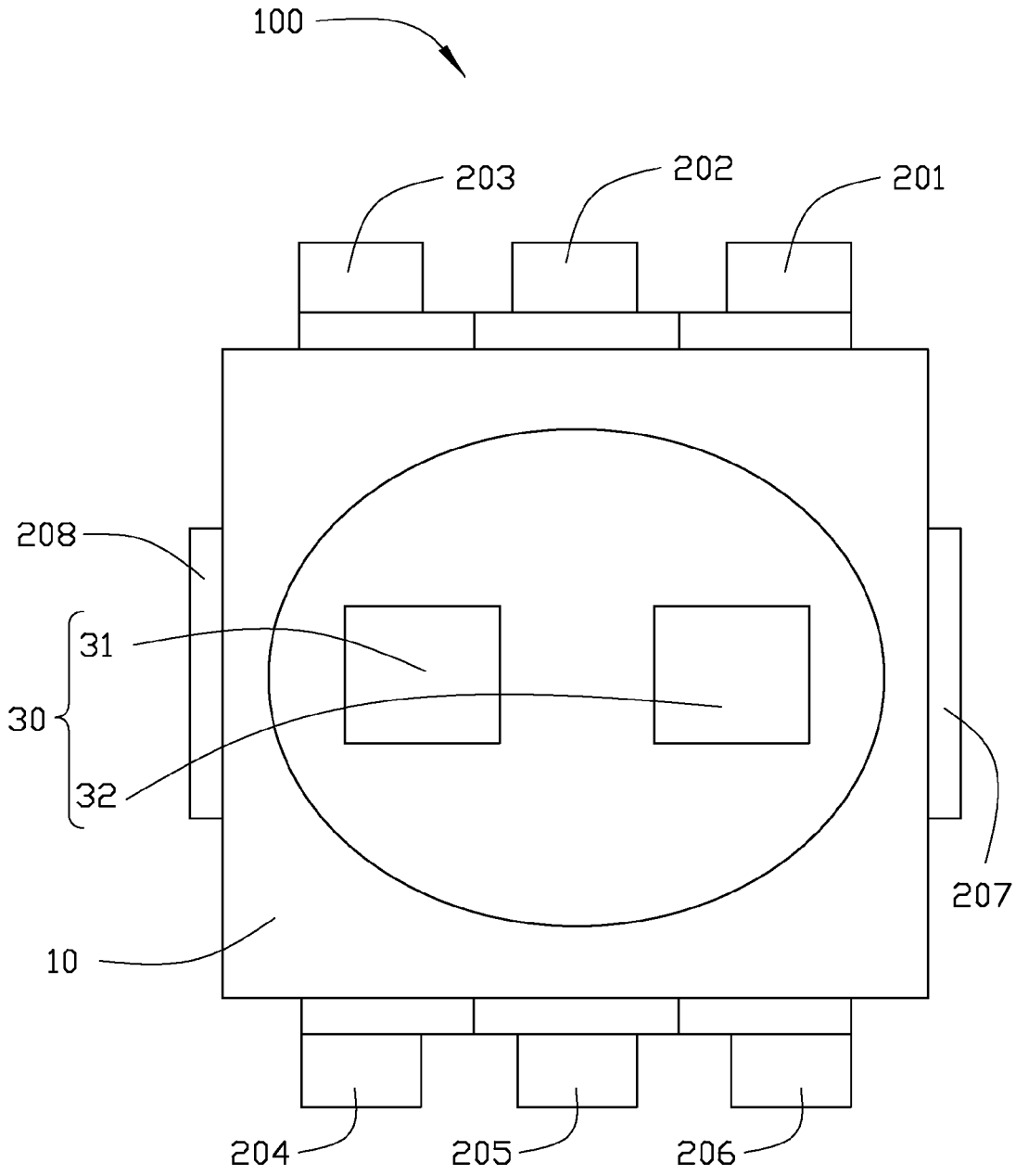


FIG. 1

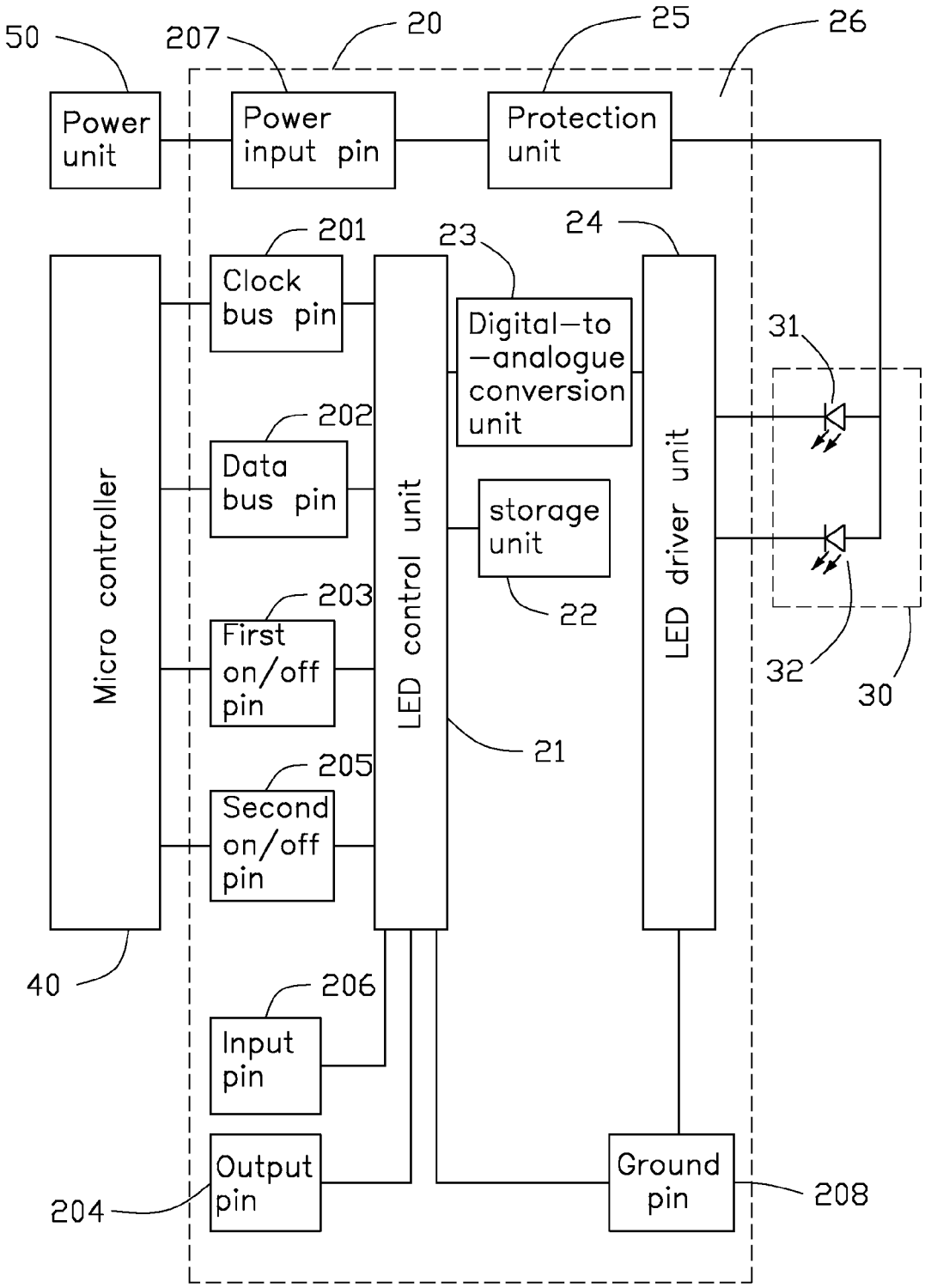

50
207
20
25
26
Power unit
Power input pin
Protection unit
201
23
24
Clock bus pin
Digital—to—analogue conversion unit
31
202
Data bus pin
storage unit
22
203
First on/off pin
205
Second on/off pin
Micro controller
LED control unit
LED driver unit
21
32
30
40
206
Input pin
Output pin
204
Ground pin
208

FIG. 2

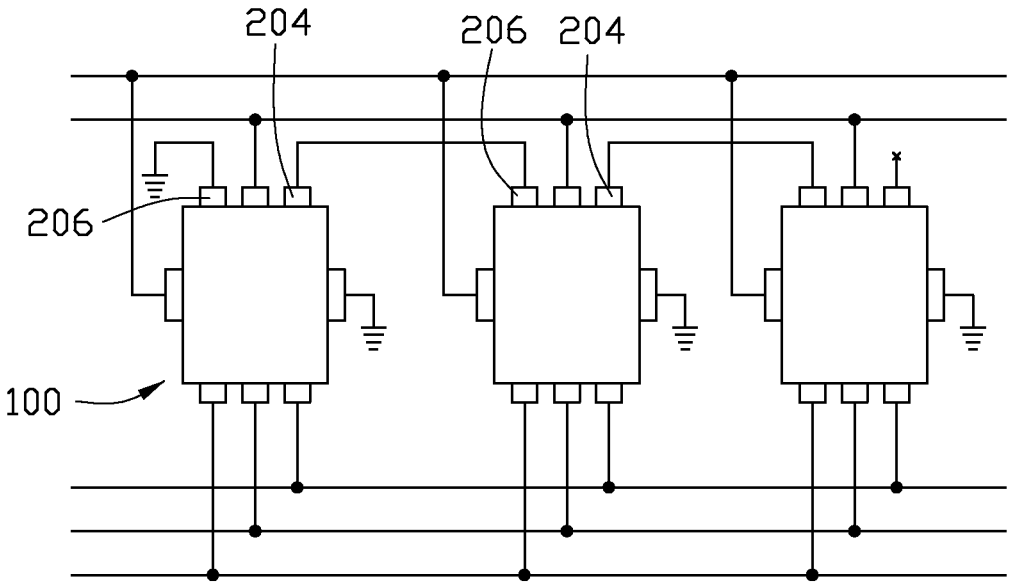


FIG. 3

LIGHT EMITTING DEVICE

FIELD

The subject matter herein generally relates to a light emitting device.

BACKGROUND

A white light emitting diode (LED) is usually provided as a flash for a camera module or a video recorder. An infrared LED is usually provided as a focusing component of a camera module or a video recorder. The white LED and the infrared LED are independently operated in an electronic device, so that both the white LED and the infrared LED are controlled by their own control units and driver units.

BRIEF DESCRIPTION OF THE DRAWINGS

Implementations of the present technology will now be described, by way of example only, with reference to the attached figures.

FIG. **1** is a diagrammatic view of a light emitting device.

FIG. **2** is a block diagram of a control module coupled to a light emitting unit and a micro controller.

FIG. **3** illustrates a circuit diagram of one embodiment of connections for multiple light emitting devices.

DETAILED DESCRIPTION

It will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have been repeated among the different figures to indicate corresponding or analogous elements. In addition, numerous specific details are set forth in order to provide a thorough understanding of the embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein can be practiced without these specific details. In other instances, methods, procedures, and components have not been described in detail so as not to obscure the related relevant feature being described. Also, the description is not to be considered as limiting the scope of the embodiments described herein. The drawings are not necessarily to scale and the proportions of certain parts may be exaggerated to better illustrate details and features of the present disclosure.

Several definitions substantially that apply throughout this disclosure will now be presented.

The term "coupled" is defined as connected, whether directly or indirectly through intervening components, and is not necessarily limited to physical connections. The connection can be such that the objects are permanently connected or releasably connected. The term "comprising," when utilized, means "including, but not necessarily limited to"; it specifically indicates open-ended inclusion or membership in the so-described combination, group, series and the like.

The present disclosure is described in relation to a light emitting device.

FIG. **1** illustrates a light emitting device **100**. The light emitting device **100** comprises a housing **10**, a control module **20** (shown in FIG. **2**), and a light emitting unit **30**.

The housing **10** is a rectangular prism and substantially hollow. The control module **20** is received by the housing **10**. The control module **20** is coupled to a micro controller **40**. At least one light emitting unit **30** is electrically connected with the control module **20**. At least one light emitting unit **30** is partially extended from the housing **10** so that the light emitting unit **30** can emit light. The control module is configured to receive control signals transmitted by the micro controller **40** to control the light emitting unit **30** to emit light with different intensity.

FIG. **2** illustrates a schematic block diagram of the control module **20**. The control module **20** comprises a LED control unit **21**, a storage unit **22**, a digital-to-analogue conversion unit **23**, a LED driver unit **24** and a protection unit **25**.

The LED control unit **21**, the storage unit **22**, the digital-to-analogue conversion unit **23**, the LED driver unit **24** and the protection unit **25** are integrated in a control chip **26**.

The LED control unit **21** is electrically connected with the storage unit **22** and the digital-to-analogue conversion unit **23**. The digital-to-analogue conversion unit **23** is electrically connected with the LED driver unit **24**. The LED driver unit **24** has a ground terminal to connect with ground side. The LED driver unit **24** is electrically connected with the light emitting unit **30**. The light emitting unit **30** is coupled to a power unit **50** through a protection unit **25**.

The control module **20** has multiple pins which comprise at least one data bus pin, at least one input pin, at least one output pin, at least one power input pin, at least one ground pin and at least one on/off pin.

In at least one embodiment, the control module **20** has eight pins which include a clock bus pin **201**, a data bus pin **202**, a input pin **206**, a output pin **204**, a power input pin **207**, a ground pin **208**, a first on/off pin **203** and a second on/off pin **205**.

In some embodiments, only one on/off pin or multiple pins can be provided. Every on/off pin is configured to control on/off status of a light emitting unit or a set of light emitting units.

In some embodiments, the on/off pin is a switch pin or is coupled to a switch mechanism. The switch pin or the switch mechanism is not limited to control the on/off status of a light emitting unit or a set of light emitting units but is configured to control on/off status of the different light emitting units or the set of light emitting units. For example, the switch mechanism could control a set of light emitting units to be half of light emitting units at "on" status and half of the set of light emitting units at "off" status.

In at least one embodiment, the clock bus pin **201**, data bus pin **202**, a first on/off pin **203** and a second on/off pin **205** are coupled to the micro controller **40** and the LED control unit **21**. The output pin **204**, the input pin **206** and the ground pin **208** are electrically connected with the LED control unit **21**. The power input pin **207** is electrically connected with the power unit **50** and protection unit **25**.

The micro controller **40** is configured to generate a control signal when a user controls and operates the light emitting device **100**. The control signal comprises information related to the intensity of the light emitting unit **30** and the on/off status of the light emitting unit **30**.

The information of the intensity of the light emitting unit **30** is transmitted through the clock bus pin **201** and the data bus pin **202** to the LED control unit **21**. In this embodiment, the clock bus pin **201** is coupled to the micro controller **40** through a clock bus (not shown). The data bus pin is coupled to the micro controller **40** through a data bus (not shown). The information of the intensity of the light emitting unit **30** is transmitted through the clock bus and the data bus to the LED control unit **21**.

The information of the on/off status is transmitted to the LED control unit **21** through the on/off pins. In at least one embodiment, the light emitting unit **30** comprises a first light emitting unit **31** and a second light emitting unit **32**. The first

light emitting unit **31** is a white LED. The second light emitting unit **32** is an infrared LED. The micro controller **40** is configured to transmit the information of the on/off status corresponding to the first light emitting unit **31** to the LED control unit **21** through the first on/off pin **203**. The micro controller **40** is configured to transmit the information of the on/off status corresponding to the second light emitting unit **32** to the LED control unit **21** through the second on/off pin **205**.

The storage unit **22** is configured to store data in a reference sheet between an intensity of the light and a current value. In at least one embodiment, the storage unit **22** is configured to store a reference sheet between the intensity of the first light emitting unit **31** and the current value of the first light emitting unit **31**. The storage unit **22** is also configured to store another reference sheet between the intensity of the second light emitting unit **32** and the current value of the second light emitting unit **32**. The reference sheet between the intensity of the light and the current value of the light is provided by the calibration information of the features of the first light emitting unit **31** and the calibration information of the features of the second light emitting unit **32**. For example, when the first light emitting unit **31** receives a specific current, a corresponding intensity of light is generated by the first light emitting unit **31** by referring to the reference sheet.

When the LED control unit **21** receives a control signal, the control signal is able to control the storage unit **22** to provide a current value based on the reference sheet. The current value and the information of the on/off status are both transmitted to the digital-to-analogue conversion unit **23**.

In at least one embodiment, the LED control unit **21** is configured to read a current value corresponding to the intensity of the first light emitting unit **31** from the storage unit **22** based on the reference sheet. The current value and the information of the on/off status corresponding to the first light emitting unit **31** are both transmitted to the digital-to-analogue conversion unit **23**. The LED control unit **21** is also configured to read another current value corresponding to the intensity of the second light emitting unit **32** from the storage unit **22**. The current value and the information of the on/off status corresponding to the second light emitting unit **32** are both transmitted to the digital-to-analogue conversion unit **23**.

The digital-to-analogue conversion unit **23** is configured to transform the current values and the information of the on/off status to a simulation signal. The simulation signal is transmitted to the LED driver unit **24**.

The LED driver unit **24** is configured to control the on/off status corresponding to the light emitting unit **30** and an intensity of the light emitting unit **30** based on a simulation signal.

In this embodiment, the LED driver unit **24** is configured to control the on/off status corresponding to the first light emitting unit **31** and the intensity of the first light emitting unit **31** based on a simulation signal. The LED driver unit **24** is also configured to control the on/off status corresponding to the second light emitting unit **32** and the intensity of the second light emitting unit **32** based on a simulation signal.

The protection unit **25** is coupled to the power unit **50** and the light emitting unit **30** for protecting the light emitting unit **30** when any current, voltage or temperature problems happen.

In some embodiments, if the current or voltage is stable when the light emitting unit **30** operates, the protection unit **25** is not provided.

The LED control unit **21**, the storage unit **22**, the digital-to-analogue conversion unit **23** and the LED driver unit **24** are all integrated on the light emitting device **100**. According to the reference sheet, every light emitting unit is tuned to the best mode for requirements of the user.

In some embodiments, the information of the intensity of the light and the information of on/off status is transmitted to the LED control unit through at least one on/off pin.

FIG. **3** illustrates an embodiment of connections among multiple light emitting devices **100**.

When the multiple light emitting devices **100** are being connected, the input pin **206** is electrically connected in series with output pin **204**.

The embodiments shown and described above are only examples. Many details are often found in the art such as the other features of a light emitting device. Therefore, many such details are neither shown nor described. Even though numerous characteristics and advantages of the present technology have been set forth in the foregoing description, together with details of the structure and function of the present disclosure, the disclosure is illustrative only, and changes may be made in the detail, especially in matters of shape, size, and arrangement of the parts within the principles of the present disclosure, up to and including the full extent established by the broad general meaning of the terms used in the claims. It will therefore be appreciated that the embodiments described above may be modified within the scope of the claims.

What is claimed is:

1. A light emitting device comprising:

at least one light emitting unit;

a micro controller coupled to the at least one light emitting unit;

a control module coupled to the micro controller and comprising:

a storage unit configured to store a reference sheet between an intensity of the at least one light emitting unit and a current value of the light emitting unit;

a light emitting diode (LED) control unit configured to receive a control signal from the micro controller, the control signal comprises an information related to the intensity of the light emitting unit and an on/off status of the light emitting unit, wherein the control signal is configured to control the storage unit to provide a current value corresponding to the intensity of the at least one light emitting unit based on the reference sheet in the storage unit;

a digital-to-analogue conversion unit configured to transform the current value and the on/off status to a simulation signal, and

a LED driver unit configured to control the on/off status and the intensity of the at least one light emitting unit based on the simulation signal.

2. The light emitting device of claim **1**, wherein the control module further comprises a protection unit coupled to the power unit and the light emitting unit, and the protection unit is configured to protect the light emitting unit when any current, voltage or temperature problems happen.

3. The light emitting device of claim **1**, wherein the control module further comprises a data bus pin coupled to the micro controller through a data bus, and the information of the intensity of the light emitting unit is transmitted through the data bus pin to the LED control unit.

4. The light emitting device of claim **3**, wherein the control module further comprises a clock bus pin coupled to the micro controller through a clock bus, and the information

of the intensity of the light emitting unit is transmitted through the clock bus pin and the data bus pin to the LED control unit.

5. The light emitting device of claim **1**, wherein the control module further comprises at least one on/off pin, the on/off pin coupled to the micro controller, and the LED control unit is configured to control the light emitting unit through transmitting the information related to the on/off status of the light emitting unit to the LED control unit.

6. The light emitting device of claim **5**, wherein the on/off pin is a switch pin, and the switch pin is configured to control on/off status of the light emitting units.

7. The light emitting device of claim **5**, wherein the on/off pin is coupled to a switch mechanism, and the switch mechanism is configured to control on/off status of the light emitting units.

8. The light emitting device of claim **1**, wherein the control module further comprises at least one on/off pin, and the on/off pin coupled to the micro controller and the LED control unit is configured to control the light emitting unit through transmitting the information related to the intensity of the light emitting unit and the on/off status of the light emitting unit to the LED control unit.

9. The light emitting device of claim **1**, wherein the control module further comprises a power input pin and a ground pin, the power input pin is coupled to a power unit and the light emitting unit, the light emitting unit is coupled to a LED driver unit, and the LED driver unit is coupled to the ground pin and drives the light emitting unit.

10. The light emitting device of claim **1**, wherein the control module further comprises an input pin and an output pin, and the input pin is electrically connected with output pin in series when the multiple light emitting devices are provided.

11. The light emitting device of claim **1**, wherein at least one white LED unit and at least one infrared LED unit are provided, and the control module comprises a first on/off pin to control the on/off status of the white LED unit, and a second on/off pin to control the on/off status of the infrared LED unit.

12. The light emitting device of claim **1**, wherein the lighting emitting device further comprises a control chip, and the storage unit, the digital-to-analogue conversion unit, the LED driver unit and the protection unit are integrated on the control chip.

13. A control module comprising:

a storage unit configured to store a reference sheet between an intensity of the at least one light emitting unit and a current value of the light emitting unit;

a light emitting diode (LED) control unit configured to receive a control signal from the micro controller, the control signal comprises an information related to the intensity of the light emitting unit and an on/off status of the light emitting unit, wherein the control signal is configured to control the storage unit to provide a current value corresponding to the intensity of the at least one light emitting unit based on the reference sheet in the storage unit;

a digital-to-analogue conversion unit configured to transform the current value and the on/off status to a simulation signal, and

a LED driver unit configured to control the on/off status and the intensity of the at least one light emitting unit based on the simulation signal.

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